SIN 516

Issue v6.0

May 24

Suppliers' Information Note

For the BT Network

21CN Optical Solution

Service & Interface Description

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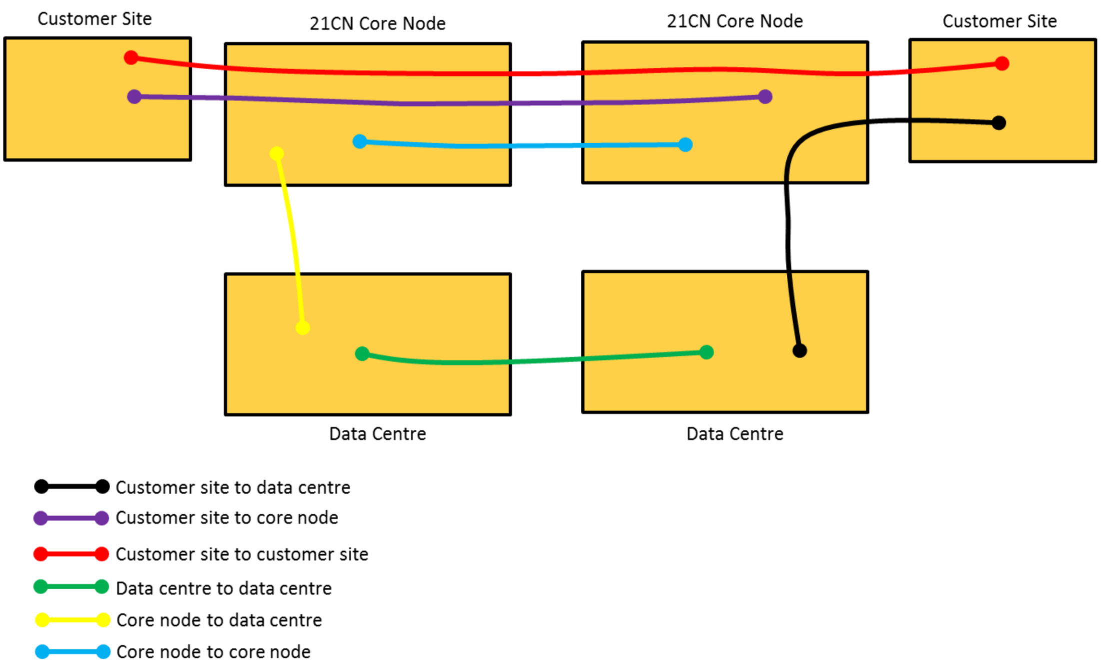
1. Introduction

This Suppliers' Information Note (SIN) describes the 21CN Optical product and its interfaces. The 21CN Optical product is a BT Connectivity Services product within the BT Optical services portfolio.

2. Service Outline

21CN Optical is an end-to-end wavelength product suitable for connecting together enterprise customer premises, communications providers' premises, third party data centres and BT 21CN Core/Metro Nodes. It is delivered over BT's 21CN optical core network, with the addition of appropriate Openreach access products if required.

BT's 21CN optical core network is constructed from Ciena AF6500 Reconfigurable Optical Add Drop Multiplexers (ROADMs) using Dense Wavelength Division Multiplexing (DWDM) technology and has been extended into third party data centres across the UK.


Customer Site
21CN Core Node
21CN Core Node
Customer Site
Data Centre
Data Centre
Customer site to data centre
Customer site to core node
Customer site to customer site
Data centre to data centre
Core node to data centre
Core node to core node

High bandwidth connectivity up to 100Gb/s per service is offered. The service is provided over a dedicated or shared 100Gb wavelength.

The elements of the service are:

- **Service:** this is the end-to-end 21CN Optical service offered to the customer via the client interface. Services offered are:
    - Ethernet: 10GE, 40GE, 100GE, 400GE
    - Fibre Channel: 1Gb, 2Gb, 4Gb, 8Gb, 10GB
    - Optical Transport Unit 10Gb (OTU2 and OTU2e), 100Gb (OTU4)

The client interface is supported on either the BT AF6500 Ciena ROADM or the appropriate Openreach access product if used to deliver the end to end 21CN Optical service.

- **Wavelength:** used to transport the services delivered to the customer. It is carried over the BT 21CN optical core network and suitable Openreach access products.
- **Openreach Access Products:** these provide connectivity from the Ciena 6500 optical multiplexer equipment installed in BT 21CN Core/Metro Nodes to the customer's equipment. Depending on the location of the customers' equipment, the Openreach access products that can be used are:
  - Ethernet Access Direct (EAD)
  - Ethernet Backhaul Direct (EBD)
  - Optical Spectrum Access Filter Connect (OSA FC) (XG210 & FSP3000)
  - OSA Cloud Connect
  - OSA 100G Single
  - Optical Spectrum Extended Access Filter Connect (OSEA FC)
  - Optical Spectrum Extended Access Filter Connect Lite (OSEA FC Lite)
  - In-building (Internal) Cablelink
  - In-span (External) Cablelink

Where the EAD, EBD, OSA, or OSEA access product is used to deliver the 21CN Optical Solution to the customer, the customer interface will be part of the EAD, EBD, OSA or OSEA product.

For details of the customer interface specifications for the Openreach EAD please refer to SIN 492 at http://www.btplc.com/sinet/. Note: Only the 10Gb Ethernet interface option is applicable to the 21CN Optical Solution. Note: Only the following interfaces are applicable to the 21CN Optical Solution:

- Ethernet: 10GE

For details of the customer interface specifications for the Openreach EBD please refer to SIN 480 at http://www.btplc.com/sinet/. Note: Only the 10Gb Ethernet interface option is applicable to the 21CN Optical Solution. Note: Only the following interfaces are applicable to the 21CN Optical Solution:

- Ethernet: 10GE

For details of the customer interface specifications for the Openreach OSA FC please refer to SIN 489 at http://www.btplc.com/sinet/. Note: Only the following interfaces are applicable to the 21CN Optical Solution:

- Ethernet: 10GE
- Fibre Channel: 1Gb, 2Gb, 4Gb, 8Gb, 10GB (FSP3000 only)
- Optical Transport Unit 10Gb (OTU2) (FSP3000 only)

For details of the customer interface specifications for the Openreach OSA Cloud Connect please refer to SIN 1004 at Suppliers' information notes (SINS) (openreach.co.uk). Note: Only the following interfaces are applicable to the 21CN Optical Solution:

- Ethernet: 10GE, 100GE
- Fibre Channel: 8Gb
- Optical Transport Unit 10Gb (OTU2 and OTU-2e)

For details of the customer interface specifications for the Openreach OSEA FC please refer to SIN 514 at http://www.btplc.com/sinet/. Note: Only the following interfaces are applicable to the 21CN Optical Solution:

- Ethernet: 10GE, 40GE, 100GE, 400GE
- Fibre Channel: 1Gb, 2Gb, 4Gb, 8Gb, 10GB
- Optical Transport Unit 10Gb (OTU2 and OTU2e), 100Gb (OTU4)

For details of the customer interface specifications for the Openreach OSEA FC Lite please refer to SIN 1002 at Suppliers' information notes (SINS) (openreach.co.uk). Note: Only the following interfaces are applicable to the 21CN Optical Solution:

- Ethernet: 10GE, 100GE

The 21CN Optical service has no maximum radial distance between the customer's equipment. However, additional amplification may be required as the fibre route distance increases.

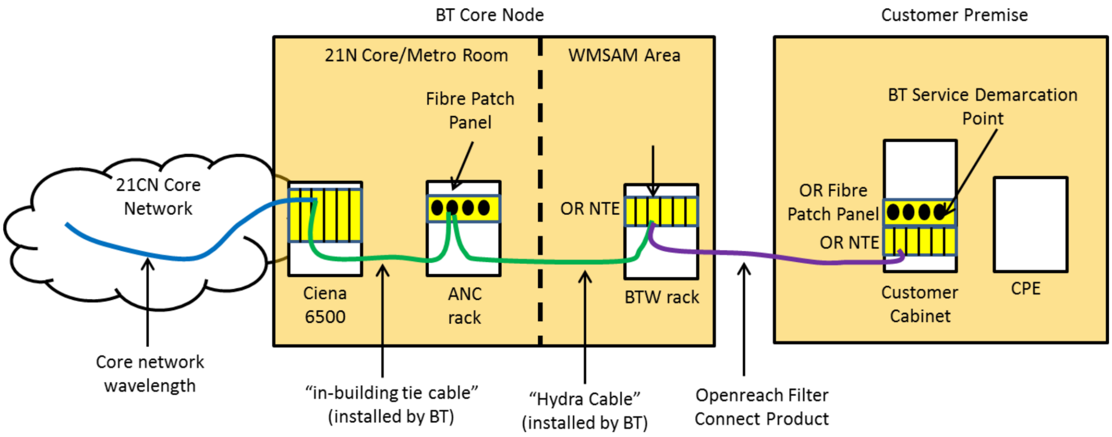
Note: When the 21CN Optical product is used to an on-net data centre, the fibre cross connect between the 21CN Optical product customer handoff point in the BT cabinet and the customer's equipment is the responsibility of the customer to provide. BT will provide the port and patch panel details of the customer handoff point in the BT cabinet to the customer.

3. Customer Interface

Active Openreach Access Products: EAD, EBD, OSA FC, OSA Cloud Connect, OSA 100G Single, OSEA FC, OSEA FC Lite

The interface presented to the customer will be the customer handoff point of the Openreach access used to deliver the 21CN Optical service. Details can be found in the appropriate Openreach product handbook.

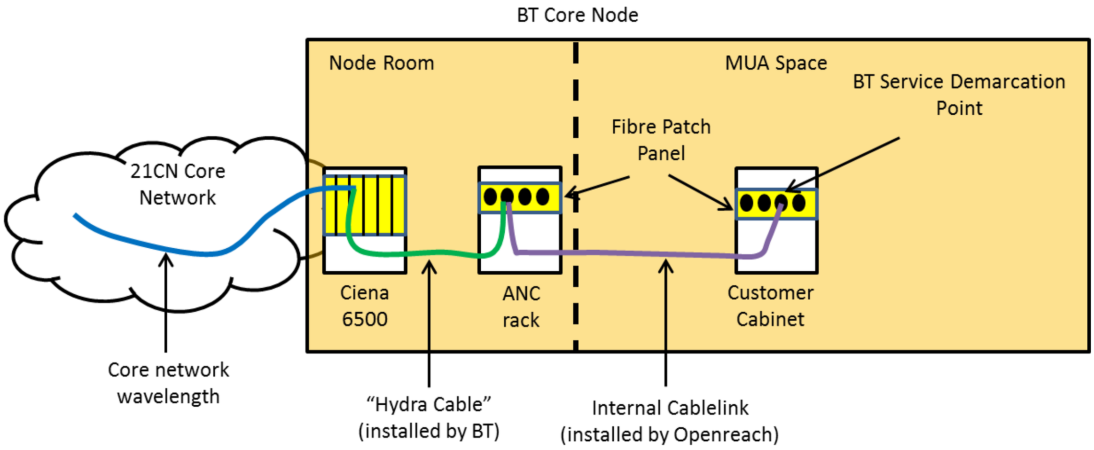
Details of the space and power requirements of the Openreach NTE can be found in the Openreach product handbooks.


BT Core Node
Customer Premise
21N Core/Metro Room
WMSAM Area
Fibre Patch Panel
BT Service Demarcation Point
21CN Core Network
OR NTE
OR Fibre Patch Panel
OR NTE
Ciena 6500
ANC rack
BTW rack
Customer Cabinet
CPE
Core network wavelength
"in-building tie cable" (installed by BT)
"Hydra Cable" (installed by BT)
Openreach Filter Connect Product

Passive Openreach Access Product: Internal Cablelink

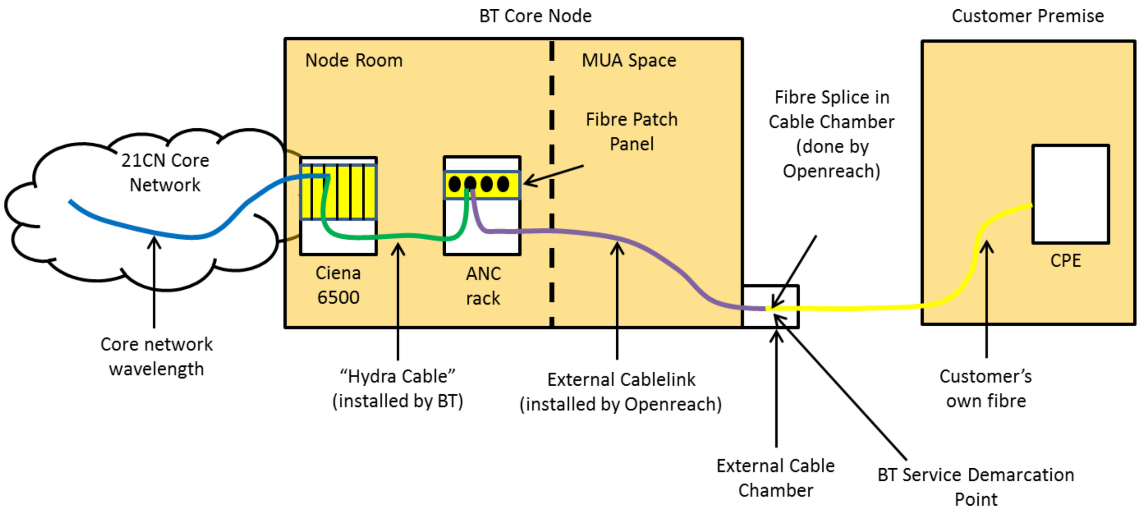
The interface presented to the customer will be via a fibre patch panel using a Subscriber Connector/ Angled Polished Connector ("SC/APC") connectors, or Subscriber Connector ("SC"), or LC/Physical Contact (LC/PC).

The space required for the fibre patch panel in the customer's cabinet is 1U.


BT Core Node
Node Room
MUA Space
BT Service Demarcation Point
Fibre Patch Panel
21CN Core Network
Ciena 6500
ANC rack
Customer Cabinet
Core network wavelength
"Hydra Cable" (installed by BT)
Internal Cablelink (installed by Openreach)

Passive Openreach Access Product: External Cablelink

The presentation to the customer will be a fibre splice between the External Cablelink and the customer's own fibre in the 21CN Core/Metro Node cable chamber. The fibre splice will be provided by Openreach and is the termination point of the Openreach External Cablelink product.

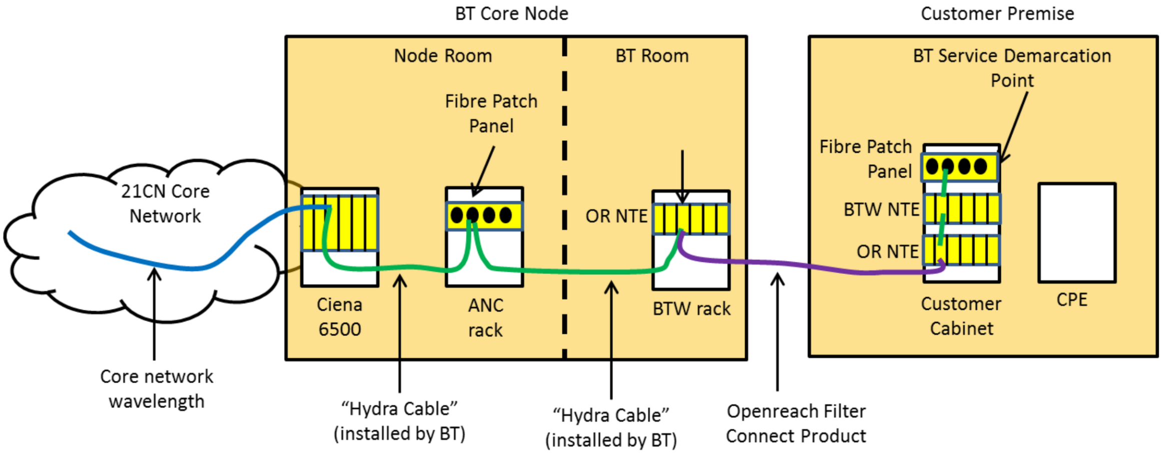

BT Core Node
Customer Premise
Node Room
MUA Space
Fibre Patch Panel
Fibre Splice in Cable Chamber (done by Openreach)
21CN Core Network
Ciena 6500
ANC rack
CPE
Core network wavelength
"Hydra Cable" (installed by BT)
External Cablelink (installed by Openreach)
Customer's own fibre
External Cable Chamber
BT Service Demarcation Point

Passive Openreach Access Product: OSA FC, OSEA FC, OSEA FC Lite

When the Wholesale Optical solution uses the active client interfaces on the OSA FC, OSEA FC and OSEA FC Lite products, refer to the section headed "Active Openreach Access Product: EAD, EBD, OSA FC, OSEA FC, OSEA FC Lite" for details of the customer interface and service handoff options.

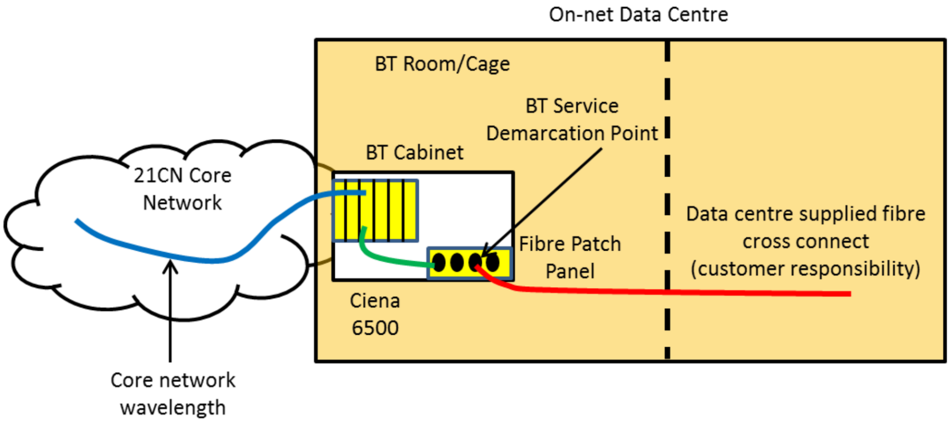
When the Wholesale Optical solution uses the passive interfaces on the OSA FC, OSEA FC and OSEA FC Lite products the interface presented to the customer will be via a fibre patch panel using a Subscriber Connector/ Angled Polished Connector ("SC/APC") connectors, or Subscriber Connector ("SC"), or LC/Physical Contact (LC/PC).

Details of the space and power requirements of the OSA FC NTE, OSEA FC NTE, OSEA FC Lite and the BT Wholesale NTE at the customer's premise can be found in the OSA FC, OSEA FC, OSEA FC Lite and Wholesale Optical product handbooks.


BT Core Node
Customer Premise
Node Room
BT Room
BT Service Demarcation Point
Fibre Patch Panel
21CN Core Network
OR NTE
Fibre Patch Panel
BTW NTE
OR NTE
Ciena 6500
ANC rack
BTW rack
Customer Cabinet
CPE
Core network wavelength
"Hydra Cable" (installed by BT)
"Hydra Cable" (installed by BT)
Openreach Filter Connect Product

On-net Data Centre

The interface presented to the customer will be via a fibre patch panel using a Subscriber Connector (“SC”), or LC/Physical Contact (LC/PC).


On-net Data Centre
BT Room/Cage
BT Service Demarcation Point
BT Cabinet
21CN Core Network
Fibre Patch Panel
Data centre supplied fibre cross connect (customer responsibility)
Ciena 6500
Core network wavelength

4. Services Supported

The 21CN Optical services are available with the following bandwidths/protocols:

- 10 Gigabit Ethernet (LAN PHY)
- 10 Gigabit Ethernet (WAN PHY)
- 40 Gigabit Ethernet
- 100 Gigabit Ethernet
- 400 Gigabit Ethernet
- 8 Gigabit Fibre Channel
- 10 Gigabit Fibre Channel
- 10 Gigabit Optical Transport Unit (OTU2) WAN PHY
- 10 Gigabit Optical Transport Unit (OTU2e) LAN PHY
- 100 Gigabit Optical Transport Unit (OTU4)

21CN Optical services are intended for connection to standard optical interfaces of 850nm multimode or 1310nm and 1550nm single mode types. 1310nm multimode fibre interfaces are not supported. No electrical interfaces are offered.

Table 1 gives details of the client interface options available whether an Openreach passive or active product is used, or if the service is delivered from an on-net data centre.

Customer Interface	Interface Type	Pluggable Type
1Gb FC	MX (MMF, 850nm) SM (SMF, 1310nm)	SFP
2Gb FC	MX (MMF, 850nm) SM (SMF, 1310nm)	SFP
4Gb FC	MX (MMF, 850nm) SM (SMF, 1310nm)	SFP
8Gb FC	FC800-MX-SN-I (MMF 850nm) FC800-SM-LL-L (SMF 1310nm)	XFP or SFP+ XFP or SFP+
10Gb FC	FC1200-MX-SN-I (MMF 850nm) FC1200-SM-LL-L (SMF 1310nm)	XFP or SFP+ XFP or SFP+
10GE LAN PHY	10GBase-LR/LW (SMF 1310nm) 10GBase-ER/EW (SMF 1550nm)	XFP or SFP+ XFP or SFP+
10GE WAN PHY	10GBase-LR/LW (SMF 1310nm) 10GBase-ER/EW (SMF 1550nm)	XFP or SFP+ XFP or SFP+
100GE	LR4 (4x25G SMF 1310nm) SR4 (850nm MMF)	CFP CFP
400GE	FR4 (4x100G SMF 1310nm)	QSFP-DD
OTU2	OTU2 / OTU2e (SMF 1310nm)	XFP or SFP+
OTU2e	OTU2 / OTU2e (SMF 1310nm)	XFP or SFP+
OTU4	LR4 (4x25G SMF)	CFP

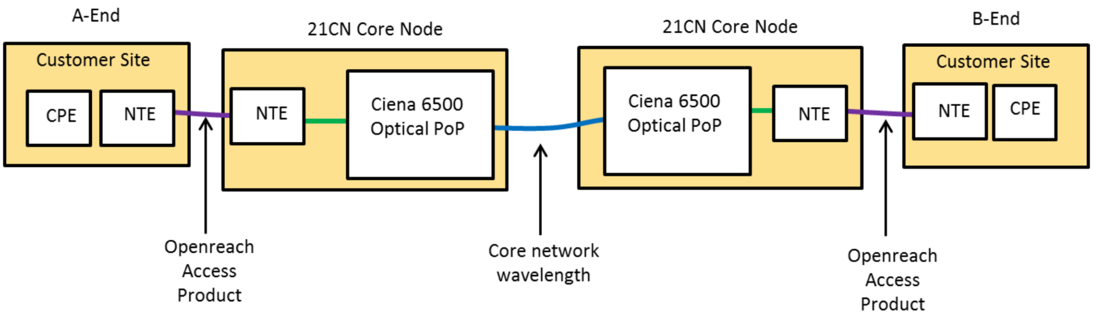
5. Service protection

Twolevels of service resilience are available:

- 21CN Optical Standard Resilience
- 21CN Optical Resilience Option 2 (a.k.a. Diverse)

Standard Resilience

Standard resilience is defined as a single unprotected path between two end points.


A-End
Customer Site
CPE
NTE
21CN Core Node
NTE
Ciena 6500 Optical PoP
21CN Core Node
Ciena 6500 Optical PoP
NTE
B-End
Customer Site
NTE
CPE
Openreach Access Product
Core network wavelength
Openreach Access Product

21CN Optical Resilience Option 2

Resilience Option 2 is defined as a pair of diversely routed unprotected paths, the routing of any RO2 variant 21CN Optical Service will look like two Standard (unprotected) routings.

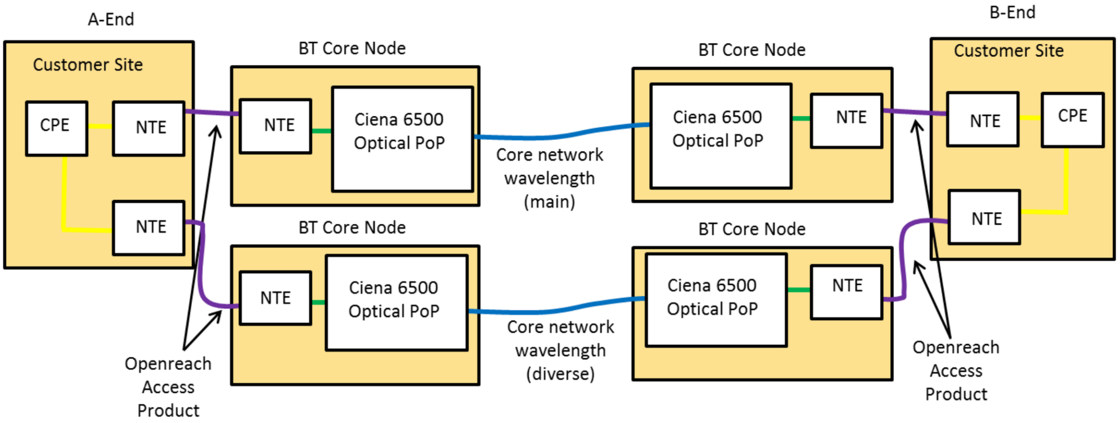
Separate Ciena AF6500 core optical ROADM equipment would be used at both ends of the service, one for each Resilience Option 2 main and diverse paths, with two client interfaces handed-off to the customer equipment.

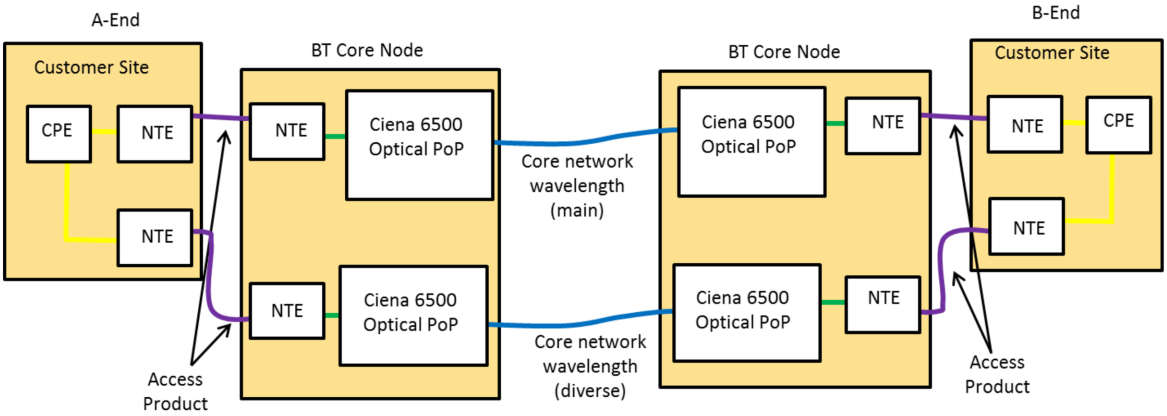
In all 21CN Core/Metro Nodes and Data Centres, there are two or more separate Ciena AF6500 core optical ROADM shelves installed in separate racks with diversely routed external fibres leaving the node by at least two separate cable entry points. This means it is possible to route two wavelengths diversely across the 21CN optical core network between any two 21CN Core/Metro Nodes and/or Data Centres.

Where an Openreach Access products are required to connect from a Customer Site to a 21CN Core/Metro Node, an RO2 variant of that product (EAD, EBD, OSA FC, OSEA FC, OSEA FC Lite) would be used to connect back to two separate Ciena AF6500 core optical ROADM shelves in either one or two 21CN Core/Metro Nodes. Note: Customer Sites must parent onto Core Nodes; they are not allowed to parent onto Data Centres.

Since Openreach does not offer “cross product” resilience, it will not be possible for the main and diverse paths at either end of a service to be provided using different Access products, e.g. an end-end service could not have one end with the main path as an OSA FC and the diverse path as an EAD.

It is possible for the “A End” & “B End” of an Resilience Option 2 service to use different optical access options, e.g. the A End could be an Resilience Option 2 variant OSA FC and the B End could be an Resilience Option 2 variant EAD.


A-End
Customer Site
CPE
NTE
NTE
BT Core Node
NTE
Ciena 6500 Optical PoP
BT Core Node
NTE
Ciena 6500 Optical PoP
Core network wavelength (main)
Core network wavelength (diverse)
BT Core Node
Ciena 6500 Optical PoP
NTE
BT Core Node
Ciena 6500 Optical PoP
NTE
B-End
Customer Site
NTE
CPE
NTE
Openreach Access Product
Openreach Access Product


A-End
Customer Site
CPE
NTE
NTE
BT Core Node
NTE
Ciena 6500 Optical PoP
NTE
Ciena 6500 Optical PoP
Core network wavelength (main)
Core network wavelength (diverse)
BT Core Node
Ciena 6500 Optical PoP
NTE
Ciena 6500 Optical PoP
NTE
B-End
Customer Site
NTE
CPE
NTE
Access Product
Access Product

For more details on the bearer/wavelength resilience options please refer to the Wholesale Optical and Optical Connect Core product description documentation.

For Wholesale Optical this can be found at: www.btwholesale.com

For Optical Connect, this can be found at: www.globalservices.bt.com

6. Geographic Availability

The 21CN Optical solution is offered throughout the UK (excluding Isles of Scilly) and in the Channel Isles subject to survey.

7. Management Overheads and Transparency Restrictions

There are some management overheads and protocol transparency restrictions for the Openreach EAD, OSA FC (XG210) and OSEA FC Lite products as detailed in the relevant SINs.

8. Buffer Crediting

The 21CN Optical solution does not support buffer crediting but is transparent to the customer own equipment distance extension protocols.

9. Fibre

Where a service employing a single mode interface is provided, all fibre connections to and from the optical patch panel use single mode fibre 9/125 micron according to ITU-T G.652

Where a service employing a multimode interface is provided, all fibre connections to and from the optical patch panel use multimode fibre 62.5/125 micron or 50/125 micron @ 850nm according to ITU-T G.651

10. Client Side Optics

Table 2 below provides details of the optical power margins for both the receive and transmit interfaces of the client facing optical interfaces. When the client interface is presented using an Openreach NTE, please refer to the Openreach product SIN (see list below) for details of optical power margins.

- EAD: SIN492
- EBD: SIN480
- OSA FC: SIN489
- OSA Cloud Connect: SIN1004
- OSEA FC: SIN514
- OSEA FC Lite: SIN1002

Supported Client Rates	Interface Type	Receiver Minimum (dBm)	Receiver Overload (dBm)	Transmit Minimum (dBm)	Transmit Overload (dBm)
1Gb Fibre Channel	MMF (850)	-14	0	09	-2.5
1Gb Fibre Channel	SMF (1310)	-17.2	-3	-11.2	-3
2Gb Fibre Channel	MMF (850)	-14	0	09	-2.5
2Gb Fibre Channel	SMF (1310)	-17.2	-3	-11.2	-3
4Gb Fibre Channel	MMF (850)	-14	0	09	-2.5
4Gb Fibre Channel	SMF (1310)	-17.2	-3	-11.2	-3
8Gb Fibre Channel	MMF (850)	-11.2	0	-8.2	0
8Gb Fibre Channel	SMF (1310)	-13.8	+0.5	-8.4	+0.5

10Gb Fibre Channel	MMF (850)	-11.2	-1	-7.5	-1
10Gb Fibre Channel	SMF (1310)	-14.4	+0.5	-8.2	+0.5
10GE LAN PHY, 10GE WAN PHY	SMF (1310)	-11	-1	-6	-1
10GE LAN PHY, 10GE WAN PHY	MMF (850)	-11.2	0	-8.2	0
100GE	SMF (1310)	-8.6	4.5	-2.3	4.5
100GE	MMF (850)	-8.6	4.5	-2.3	4.5
400GE	SMF (1310)				
OTU2	SMF (1310)	-11	-1	-6	-1
OTU2e	SM (1310)	-13	-1	-6	-1
OTU4	SMF (1310)	-8.8	+4	-2.5	+4

11. Further Information

For enquiries concerning connection availability between particular sites and for further product information about the 21CN Optical solution, please contact your BT Account Manager or Sales Specialist.

If you have enquiries relating to this document then please contact: sinet.helpdesk@bt.com

12. References

1	ITU-T G651	Recommendation G.651 – Characteristics of a 50/125um multimode graded index optical fibre cable
2	ITU-T G.652	Recommendation G.652 – Characteristics of a single mode optical fibre cable
3	IEC 61754-7	Standard for “Fibre Optic Interconnecting Devices & Passive Components – Fibre Optic Connector Interfaces – Part 7 MPO Connector Family
4	ETSI	European Telecommunication Standards Institute
5	SIN 489	Optical Spectrum Access, Service & Interface Description
6	SIN 514	Optical Spectrum Extended Access 6500 (OSEA 6500), Service & Interface Description
7	SIN 492	Ethernet Access Direct (EAD) Service & Interface Description

8	SIN 480	Ethernet Backhaul Direct (EBD) Service & Interface Description
9	SIN 1002	Optical Spectrum Extended Access Filter Connect Lite™ Service & Interface Description
10	SIN 1004	Optical Spectrum Cloud Connect Service & Interface Description

13. Glossary of Terms

Abbreviation or term	**Explanation**
21CN	21st Century Network
BT	British Telecommunications plc
DWDM	Dense Wave Division Multiplexing
Gb	Gigabits per Second
LAN	Local Area Network
LC	Little Connector, Lucent Connector, Local Connector
MM	MultiMode
NTP	Network Terminating Point
OSA	Optical Spectrum Access
OSEA	Optical Spectrum Extended Access
PHY	Physical Layer
SIN	Supplier Information Note
SM	Single Mode
WAN	Wide Area Networks
WDM	Wave Division Multiplexing

14. Document Change Control

Date	Version	Reason for Change	Author	Contact Details

29/06/2015	1	First issue	T Hubbard	tim.hubbard@bt.com
March 2016	2	Addition of LC connectors as service handover option	T Hubbard	tim.hubbard@bt.com
April 2018	3	Addition of RO1, new Openreach access products, new client interfaces	T Hubbard	tim.hubbard@bt.com
January 2019	4	Addition of OSA and OSEA Filter Connect Openreach access products	T Hubbard	tim.hubbard@bt.com
February 2022	5	Addition of Openreach OSEA FC Lite access product	D Loe	david.2.loe@bt.com
April 2024	6	Addition of 400GE. Addition of Openreach OSA Cloud Connect & OSA 100G Single products	D Loe	david.2.loe@bt.com